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(54) **BLOCKCHAIN EVENT PROCESSING METHOD AND APPARATUS**

(57) The present specification provides a blockchain event processing method and apparatus, applied to a control component of distributed event processing centers connected to a node device of a blockchain network. The distributed event processing centers obtain respective blockchain event streams from the node device, and deliver the obtained respective blockchain event streams to respective triggers included in the distributed event processing centers, so that when a blockchain event included in the blockchain event streams meets a corresponding trigger condition, a trigger of the triggers pushes the blockchain event to a service system connected to the trigger. The method includes: obtaining push speeds of a plurality of triggers included in an event processing center of the distributed event processing centers; and if a difference among the push speeds of the plurality of triggers is greater than a predetermined first threshold, establishing a new event processing center between the event processing center and a child event processing center of the event processing center, and moving the plurality of triggers to the new event processing center.

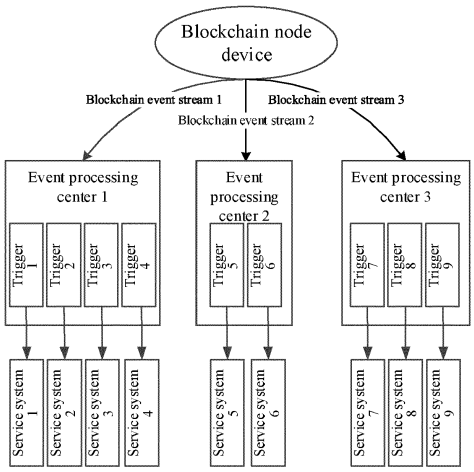

FIG. 3

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Description

TECHNICAL FIELD

[0001] One or more implementations of the present specification relate to the network communication field, and in particular, to a blockchain event processing method and apparatus.

BACKGROUND

[0002] Various events are generated when a user uses the blockchain. For example, a new block is generated after a network consensus is reached. The user initiates a transaction by using a software development kit (SDK) and writes the transaction into a ledger. Alternatively, the user invokes a function of a certain smart contract to perform a specific operation. These events are of great value to an external service system. The external service system can process the information, and feedback a processing result to an actual service. For example, a change of a certain account balance on the blockchain is monitored by subscribing to a specific event. Alternatively, a block mining speed, a transaction speed, etc., in the network are monitored by subscribing to a specific event.

[0003] In practice, there are generally a plurality of systems expecting to subscribe to an event from a blockchain node: When initiating a transaction, the SDK needs to subscribe to an event to determine whether the transaction is successfully executed and written into the ledger. A monitoring system needs to subscribe to an event to monitor counter data such as the block mining speed and the number of transactions in the blockchain network. A service system needs to perform different operations based on a change of a specific state on the blockchain.

SUMMARY

[0004] In view of these, one or more implementations of the present specification provide a blockchain event processing method, applied to a control component of distributed event processing centers connected to a node device of a blockchain network. The distributed event processing centers obtain respective blockchain event streams from the node device, and deliver the obtained respective blockchain event streams to respective triggers included in the distributed event processing centers, to push a blockchain event included in the blockchain event streams to a service system corresponding to a trigger of the triggers when the blockchain event meets a trigger condition in the trigger.

[0005] The method includes: obtaining push speeds of a plurality of triggers included in an event processing center of the distributed event processing centers; and if a difference among the push speeds of the plurality of triggers is greater than a predetermined first threshold, establishing a new event processing center, and moving, to the new event processing center, a trigger having a push speed that is different from a highest push speed of the push speeds by an amount greater than the first threshold, or a trigger having a push speed that is different from a lowest push speed of the push speeds by an amount greater than the first threshold.

[0006] In an illustrative implementation, the method further includes: establishing a sequence among the distributed event processing centers by sorting the distributed event processing centers level by level based on a delivery progress of each event processing center on a respective blockchain event stream, where a delivery progress of a parent event processing center on a blockchain event stream of the parent processing center is greater than a delivery progress of a child event processing center of the parent event processing center on a blockchain event stream of the child processing center.

[0007] In an illustrative implementation, the establishing the new event processing center, and moving, to the new event processing center, the trigger having a push speed that is different from the highest push speed by an amount greater than the first threshold, or the trigger having a push speed that is different from the lowest push speed by an amount greater than the first threshold includes: establishing a new child event processing center for the event processing center, and moving, to the new child event processing center, the trigger having a push speed that is different from the highest push speed by an amount greater than the first threshold; or establishing a new parent event processing center for the event processing center, and moving, to the new parent event processing center, the trigger having a push speed that is different from the lowest push speed by an amount greater than the first threshold.

[0008] In an illustrative implementation, the method further includes: obtaining a delivery progress of each event processing center in the distributed event processing centers on a respective blockchain event stream; and if a second delivery progress of a child event processing center of a parent event processing center in the distributed event processing centers on a blockchain event stream of the child event processing center is not less than a first delivery progress of the parent event processing center on a blockchain event stream of the parent event processing center, moving each trigger in the child event processing center to the parent event processing center, and removing the child event processing center.

[0009] In an illustrative implementation, the method further includes: if the second delivery progress of the child event processing center is less than the first delivery progress of the parent event processing center, and a difference between the second delivery progress and the first delivery progress is less than a predetermined second threshold, suspending the parent event processing center from delivering the blockchain event stream obtained by the parent event processing center to each trigger of the parent event processing center; when the sec-

ond delivery progress becomes not less than the first delivery progress, moving the trigger included in the child event processing center to the parent event processing center, and removing the child event processing center; and restarting the parent event processing center to continue to deliver the blockchain event stream obtained by the parent event processing center to each trigger included in the parent event processing center.

[0010] In an illustrative implementation, the method further includes: removing an event processing center if the event processing center in the distributed event processing centers does not include any trigger.

[0011] In an illustrative implementation, the event processing center is a software development kit component coupled to the node device.

[0012] In an illustrative implementation, the method further includes: creating a new event processing center, the new event processing center including a new trigger, and the new trigger declaring a start or initial location of a blockchain event stream subscribed to by a service system corresponding to the new trigger; and setting the new event processing center as a parent event processing center of a first event processing center having a delivery progress that is less than the start or initial location.

[0013] In an illustrative implementation, the control component includes centralized control components, and the centralized control components are separately communicatively connected to the distributed event processing centers.

[0014] In an illustrative implementation, the control component includes distributed control components that are separately disposed in the distributed event processing centers, and each event processing center in the distributed event processing center sequence is communicatively connected to an adjacent event processing center.

[0015] The present specification further provides a blockchain event processing apparatus, applied to a control component of distributed event processing centers connected to a node device of a blockchain network. The distributed event processing centers obtain respective blockchain event streams from the node device, and deliver the obtained respective blockchain event streams to respective triggers included in the distributed event processing centers, to push a blockchain event included in the blockchain event streams to a service system corresponding to a trigger of the triggers when the blockchain event meets a trigger condition in the trigger.

[0016] The apparatus includes: an acquisition unit, configured to obtain push speeds of a plurality of triggers included in an event processing center of the distributed event processing centers; and an establishment unit, configured to: if a difference among the push speeds of the plurality of triggers is greater than a predetermined first threshold, establish a new event processing center, and move, to the new event processing center, a trigger having a push speed that is different from a highest push speed of the push speeds by an amount greater than the first threshold, or a trigger having a push speed that is different from a lowest push speed of the push speeds by an amount greater than the first threshold.

[0017] In an illustrative implementation, the apparatus further includes: a sorting unit, configured to establish a sequence among the distributed event processing centers by sorting the distributed event processing centers level by level based on a delivery progress of each event processing center on a respective blockchain event stream, where a delivery progress of a parent event processing center on a blockchain event stream of the parent processing center is greater than a delivery progress of a child event processing center of the parent event processing center on a blockchain event stream of the child processing center.

[0018] In an illustrative implementation, the establishment unit is further configured to: establish a new child event processing center for the event processing center, and move, to the new child event processing center, the trigger having a push speed that is different from the highest push speed by an amount greater than the first threshold; or establish a new parent event processing center for the event processing center, and move, to the new parent event processing center, the trigger having a push speed that is different from the lowest push speed by an amount greater than the first threshold.

[0019] In an illustrative implementation, the acquisition unit is further configured to obtain a delivery progress of each event processing center in the distributed event processing centers on a respective blockchain event stream; a movement unit is configured to: if a second delivery progress of a child event processing center of a parent event processing center in the distributed event processing centers on a blockchain event stream of the child event processing center is not less than a first delivery progress of the parent event processing center on a blockchain event stream of the parent event processing center, move each trigger in the child event processing center to the parent event processing center; and a removal unit is configured to remove the child event processing center.

[0020] In an illustrative implementation, the apparatus further includes: a suspending unit, configured to: if the second delivery progress of the child event processing center is less than the first delivery progress of the parent event processing center, and a difference between the second delivery progress and the first delivery progress is less than a predetermined second threshold, suspend the parent event processing center from delivering the blockchain event stream obtained by the parent event processing center to each trigger of the parent event processing center, where the movement unit is further configured to: when the second delivery progress becomes not less than the first delivery progress, move the trigger included in the child event processing center to the parent event processing center; and the removal unit is further configured to remove the child event processing center; and a restart unit, configured to restart the parent

event processing center to continue to deliver the blockchain event stream obtained by the parent event processing center to each trigger included in the parent event processing center.

[0021] In an illustrative implementation, the removal unit is configured to remove an event processing center in response to the event processing center in the distributed event processing centers not including any trigger.

[0022] In an illustrative implementation, the event processing center is a software development kit component coupled to the node device.

[0023] In an illustrative implementation, the establishment unit is configured to create a new event processing center, the new event processing center including a new trigger, and the new trigger declaring a start or initial location of a blockchain event stream subscribed to by a service system corresponding to the new trigger; and the sorting unit is configured to set the new event processing center as a parent event processing center of a first event processing center having a delivery progress that is less than the start or initial location.

[0024] In an illustrative implementation, the control component includes centralized control components, and the centralized control components are separately communicatively connected to the distributed event processing centers.

[0025] In an illustrative implementation, the control component includes distributed control components that are separately disposed in the distributed event processing centers, and each event processing center in the distributed event processing center sequence is communicatively connected to an adjacent event processing center.

[0026] The present specification further provides a computer device, including a storage device and a processor. The storage device stores a computer program that can be run by the processor, and when running the computer program, the processor performs the blockchain event processing method performed by the control component.

[0027] According to the blockchain event processing method and apparatus, and the computer devices that are provided in the implementations of the present specification, the node device is connected to the distributed event processing centers. A plurality of triggers are disposed in the same event processing center, where a difference among push speeds of the triggers is less than a predetermined threshold. It can be ensured that a plurality of triggers with comparable push speeds trigger and push an event in the same event processing center. This effectively avoids wasting resources caused by a trigger with a high push speed having to wait for a trigger with a low push speed for a long time in the same event processing center, and improves event push efficiency of the event processing center. In addition, the plurality of triggers share the same blockchain event stream in the same event processing center. Compared with a setting in which each trigger uses one blockchain event stream, network traffic overheads are effectively reduced, and network setting costs are reduced.

BRIEF DESCRIPTION OF DRAWINGS

[0028]

FIG. 1A is a schematic diagram illustrating push processing on a blockchain event stream according to an existing implementation, and FIG. 1B is a schematic diagram illustrating push processing on a blockchain event stream according to another existing implementation;

FIG. 2 is a flowchart illustrating a method for performing push processing on a blockchain event stream by distributed event processing centers according to an example implementation;

FIG. 3 is a schematic diagram illustrating push processing performed by distributed event processing centers on a blockchain event stream according to an example implementation;

FIG. 4A is a schematic diagram illustrating push processing performed by a distributed event processing center sequence on a blockchain event stream according to an example implementation, FIG. 4B is a schematic diagram illustrating a split process of distributed event processing centers according to an example implementation, and FIG. 4C is a schematic diagram illustrating a combination process of distributed event processing centers according to an example implementation;

FIG. 5A is a schematic diagram illustrating push processing performed by a chained distributed event processing center sequence on a blockchain event stream according to an example implementation, FIG. 5B is a schematic diagram illustrating a split process of distributed event processing centers according to an example implementation, and FIG. 5C is a schematic diagram illustrating a combination process of distributed event processing centers according to an example implementation;

FIG. 6 is a schematic diagram illustrating a blockchain event processing apparatus applied to a node of a control component according to an example implementation; and

FIG. 7 is a hardware structural diagram illustrating an implementation of running a blockchain event processing apparatus according to the present specification.

DESCRIPTION OF IMPLEMENTATIONS

[0029] Example implementations are described in detail herein, and examples of the example implementations are presented in the accompanying drawings. When the following descriptions relate to the accompanying drawings, unless specified otherwise, same numbers in different accompanying drawings represent same

or similar elements. Implementations described in the following example implementations do not represent all implementations consistent with one or more implementations of the present specification.

[0030] It should be noted that in another implementation, steps of a corresponding method are not necessarily performed in a sequence shown and described in the present specification. In some other implementations, the method can include steps more or fewer than those described in the present specification. In addition, a single step described in the present specification can be divided into a plurality of steps for description in another implementation. However, a plurality of steps described in the present specification can also be combined into a single step for description in another implementation.

[0031] A blockchain or a blockchain network described in the present specification can be specifically a P2P network system that has a distributed data storage structure and that is implemented by node devices by using a consensus mechanism. Ledger data in the blockchain is distributed in "blocks" that are connected to each other in terms of time. A subsequent block can include a data digest of a previous block, and full backup of data on all or some nodes is implemented based on a specific consensus mechanism (for example, POW, POS, DPOS, or PBFT).

[0032] Real data generated in the physical world can be constructed into a transaction under a standard transaction format supported by the blockchain, and then published to the blockchain. A node device in the blockchain performs consensus processing on a received transaction. After a consensus is reached, a node device that serves as an accounting node in the blockchain packages the transaction into a block, and performs persistence storage in the blockchain.

[0033] Regardless of which consensus algorithm is used in the blockchain, the accounting node can package the received transaction to generate a newest block, and send the generated newest block to another node device for consensus verification. After receiving the newest block, if verifying that there is no problem, the another node device can add the newest block to the end of the original blockchain, to complete a blockchain accounting process. When verifying the new block sent by the accounting node, the another node can also execute a transaction included in the block.

[0034] It should be noted that, each time a newest block is generated in the blockchain, after a transaction in the newest block is executed, a state corresponding to the executed transaction in the blockchain changes accordingly. For example, in a blockchain constructed by using an account model, an account state of an external account or a smart contract account usually changes accordingly as a transaction is executed.

[0035] For example, after a "transfer transaction" in a block is executed, balances of a transfer-out account and a transfer-in account, for example, field values of balance fields of the accounts, that are related to the "transfer transaction" usually change accordingly.

[0036] For another example, a "smart contract invoking transaction" in a block is used to invoke a smart contract deployed in the blockchain. The smart contract is invoked in an EVM corresponding to the node device, to execute the "smart contract invoking transaction," and update a data state corresponding to the smart contract invoking transaction based on an execution result.

[0037] In practice, a public chain, a private chain, or a consortium chain each may provide functions of a smart contract. The smart contract on the blockchain is a contract that can be triggered by a transaction for execution on the blockchain. The smart contract can be defined in a form of codes.

[0038] After the smart contract is created, a contract account corresponding to the smart contract appears on the blockchain and has a specific address. Contract codes and account storage are stored in account storage of the contract account. A behavior in the smart contract is controlled by the contract codes, and the account storage of the smart contract keeps a contract state. In other words, the smart contract enables a virtual account including contract codes and account storage to be generated on the blockchain.

[0039] The smart contract can be executed independently on each node in the blockchain network by using a specified method, and all execution records and data are stored on the blockchain. Therefore, after such a transaction is executed, transaction credentials that cannot be tampered with and cannot be lost are stored on the blockchain. An execution result of the smart contract can be stored in a Merkle Patricia Trie (MPT) receipt tree in a form of a transaction execution log, or can be stored in a storage tree of the smart contract in a form of a key-value pair.

[0040] Various events are generated when a user uses the blockchain. For example, a new block is generated after a network consensus is reached. The user initiates a transaction by using a software development kit (SDK) and writes the transaction into a ledger. Alternatively, the user invokes a function of a certain smart contract to perform a specific operation. These events are of great value to an external service system. The external service system can process the information, and feedback a processing result to an actual service. For example, a change of a certain account balance on the blockchain is monitored by subscribing to a specific event. Alternatively, a block mining speed, a transaction speed, etc., in the blockchain network are monitored by subscribing to a specific event.

[0041] In practice, there are generally a plurality of service systems expecting to subscribe to an event from a blockchain node: When initiating a transaction, the SDK needs to subscribe to an event to determine whether the transaction is successfully executed and written into the ledger. A monitoring system needs to subscribe to an event to monitor counter data such as the block mining speed and the number of transactions in the blockchain

network. A service system needs to perform different operations based on a change of a specific state on the blockchain.

[0042] The SDK of the blockchain network usually provides a subscription interface for an event. For example, an SDK of HyperLedger Fabric provides subscription interfaces for a block, a transaction, and a contract event. The technician can directly push a subscribed event to an external service based on service logic by using the SDK. As shown in FIG. 1A, when the event needs to be pushed to a plurality of external service systems, a plurality of subscription event streams can be generated by using the SDK, and are pushed to corresponding external service systems. When an event is processed by using the method, a new event stream is created each time a new external service system is added, and traffic at a network ingress increases.

[0043] In another solution, as shown in FIG. 1B, one subscription event stream is used to push received events to each external service system. When an event is processed by using the method, network traffic does not increase as the amount of service of external service systems increases. This can significantly reduce network traffic overheads. However, this solution has a disadvantage. An overall event push speed depends on an external service system with the lowest processing speed. When an external service system processes an event slowly, event processing speeds of other service systems decrease accordingly. A reason is that the external service systems share one event stream.

[0044] In view of these, one or more implementations of the present specification provide a blockchain event push method, applied to a distributed event processing center corresponding to a node device of a blockchain network. Each event processing center includes several triggers that are used to push a blockchain event to corresponding service systems.

[0045] The distributed event processing center in one or more implementations of the present specification can include a plurality of event processing centers. The plurality of event processing centers can be disposed inside the node device, or can be disposed outside the node device, and are connected to the node device. Alternatively, the plurality of event processing centers can be partially disposed inside the node device, and partially disposed outside the node device.

[0046] In an illustrative implementation, the event processing center is an event processing component bound to the node device, for example, an SDK component. Each event processing center can obtain a blockchain event stream from the node device, and push a blockchain event in the obtained blockchain event stream to several service systems connected to the event processing center.

[0047] For example, each event processing center in the distributed event processing center includes several triggers corresponding to the service systems. The "trigger" in implementations provided in the present specification can include an event trigger and push process running in an event processing center. The event trigger and push process is responsible for determining whether a blockchain event included in a blockchain event stream meets a predetermined trigger condition for pushing, and when the blockchain event included in the blockchain event stream meets the corresponding trigger condition, the blockchain event is pushed to a service system connected to the event trigger and push process, for example, the trigger. Therefore, the trigger or the event trigger and push process in implementations of the present specification corresponds to a service system connected to the trigger or the process, that is, each trigger or each event trigger and push process declares a trigger condition of a service system corresponding to the trigger or the event trigger and push process. Each trigger can correspond to a service system to execute a push service for a blockchain event subscribed to by the service system. In some cases, a plurality of triggers can correspond to the same service system, but are responsible for executing blockchain events that are subscribed to by the service system and that meet or under different conditions.

[0048] Content of the trigger condition is not specifically limited in the present specification, and the trigger condition can further include unconditional triggering of any blockchain event or conditional triggering of a blockchain event. The conditional triggering of the blockchain event can include a blockchain event subscription condition of each service system. For example, a first service system needs to subscribe to an event to determine whether a transaction initiated by the first service system is successfully executed and written into a ledger. In this case, a trigger condition (or a subscription condition) of the first service system includes a transaction sent by the first service system. A second service system needs to subscribe to an event to monitor counter data such as a block mining speed and the number of transactions in the blockchain network. In this case, a trigger condition (or a subscription condition) of the second service system can include a new block event on the blockchain and a transaction recording event on the blockchain. A third service system needs to perform a corresponding operation based on a change of an execution state of a specific smart contract on the blockchain. In this case, a trigger condition (or a subscription condition) of the third service system can include a state of an execution result of the smart contract with a specific address.

[0049] As shown in FIG. 2, a blockchain event push method provided in this implementation includes the following steps.

[0050] Step 202: Distributed event processing centers obtain respective blockchain event streams from a node device.

[0051] The blockchain event stream can include blockchain events sorted based on a predetermined condition (such as a sequence of event generation times), and new blockchain events can be continuously generated as a

block height increases, thereby forming the "blockchain event stream." It should be noted that the blockchain event stream can include a blockchain event stream that is generated by the node device by parsing data content stored on the blockchain and that starts from an initial or start subscription location of any newly created event processing center, or can include a "blockchain stream" that is directly pulled by an event processing center from the node device and that meets an initial subscription location of the event processing center when the event processing center is created. As the event processing center locally continuously parses the obtained block stream, an event stream including blockchain events can be generated. Specific content of the blockchain event stream is not limited in the present specification.

[0052] In this implementation, as shown in FIG. 3, each event processing center in the distributed event processing centers can obtain a blockchain event stream of the event processing center from the node device. When each event processing center is initialized, start or initial locations of the blockchain event streams obtained by the event processing centers from the node device can be the same, for example, all the streams start from a genesis block, or can be different, for example, service systems corresponding to some event processing centers start the blockchain event subscription from block 100, and service systems corresponding to some event processing centers start the blockchain event subscription from block 1000. This is not limited in the present specification.

[0053] Step 204: The distributed event processing centers deliver the respective obtained blockchain event streams to respective triggers included in the distributed event processing centers, to push a blockchain event included in the blockchain event streams to a service system corresponding to a trigger of the triggers when the blockchain event meets a trigger condition in the trigger, where a difference between a maximum, e.g., the highest, push speed and a minimum, e.g., the lowest, push speed of all triggers on blockchain events that are included in an event processing center of the distributed event processing centers is less than a predetermined first threshold.

[0054] In this implementation, as shown in FIG. 3, event processing centers 1, 2, and 3 each can include a plurality of triggers, and the plurality of triggers share the same blockchain event stream. To enable the plurality of triggers in each event processing center to have comparable push speeds in a process such as determining, triggering, and pushing the blockchain event stream, and avoid wasting computing resource caused by a trigger with a high push speed having to wait for a trigger with a low push speed for a long time after the trigger processes a certain blockchain event, a difference between a maximum, e.g., the highest, push speed and a minimum, e.g., the lowest, push speed of all triggers on the blockchain events that are included in the event processing center is less than the predetermined first threshold.

[0055] The following provides a method for calculating push speeds of a plurality of triggers in an illustrative implementation: Because a plurality of triggers included in one event processing center share a blockchain event stream delivered by the event processing center, within a predetermined duration, the respective total numbers of blockchain events processed by each of all the triggers of the event processing center are equal. For example, within the predetermined duration, event processing center 1 obtains M blockchain events from the node device, and delivers the M blockchain events to each trigger. Event processing center 1 can record a total time Ti consumed by each trigger to push an event to a service system within the predetermined duration, the total number N of events pushed by the trigger to the service system connected to the trigger, and a push speed Vi=N/Ti of each trigger, for example, triggers 1, 2, 3, and 4, to conveniently calculate a difference between a maximum, e.g., the highest, push speed and a minimum, e.g., the lowest, push speed of all the triggers on the blockchain events.

[0056] The push speed of each trigger on the blockchain events is related to a configuration or a processing speed of the service system connected to the trigger. In addition, the push speed is also affected by a network connection status between the event processing center and the service system.

[0057] In an illustrative implementation, to prevent the push speed of each trigger from being affected by a sudden change of the network connection status or the processing speed of the service system, a cache event queue can be set for each trigger of the event processing center. After receiving the blockchain event stream, the event processing center sequentially writes events into cache queues of all the triggers in the event processing center within the predetermined duration, and the triggers read the events from the respective cache queues and push the events to external service systems.

[0058] A plurality of triggers are disposed in the same event processing center, where a difference among push speeds of the triggers is less than the predetermined first threshold. It can be ensured that a plurality of triggers with comparable push speeds trigger and push an event in the same event processing center. This effectively avoids wasting resources caused by a trigger with a high push speed having to wait for a trigger with a low push speed for a long time, and improves event push efficiency of the event processing center. In addition, the plurality of triggers share the same blockchain event stream in the same event processing center. Compared with a setting that each trigger uses one blockchain event stream, network traffic overheads are effectively reduced, and network setting costs are reduced.

[0059] To manage blockchain event processing and push processes of the distributed event processing centers, the present specification provides two specific management methods: The distributed event processing centers are managed by using centralized control com-

ponents, and the centralized control components are separately communicatively connected to the distributed event processing centers. Alternatively or additionally, a distributed control component that is loaded in each event processing center in the distributed event processing centers and that is constructed by using codes performs self-distributed management on the distributed event processing centers, that is, the control components are distributed control components that are separately disposed in the distributed event processing centers, and each event processing center is directly or indirectly communicatively connected to another event processing center. The following content of the present specification describes the two implementations in detail. A person skilled in the art can further set another management method for the distributed event processing centers based on the two implementations. This is not limited in the present specification.

[0060] In an illustrative implementation, centralized control components that manage the distributed event processing centers can be disposed inside the node device, or can be outside and connected to the node device. The control component can receive a report of a delivery progress of each event processing center on a respective blockchain event stream, and provide an operation instruction such as establishing a new event processing center, combining existing event processing centers, creating a new trigger, or deleting a trigger.

[0061] The delivery progress of each event processing center on the respective blockchain event stream can include a location, in the blockchain, of a newest blockchain event delivered by each event processing center to the trigger. For example, the location can be represented as a block height corresponding to the newest blockchain event delivered to the trigger, or a block height and a transaction sequence number that correspond to the blockchain event.

[0062] For further convenience of management, as shown in FIG. 4A, the control component can establish a sequence among the distributed event processing centers by sorting the distributed event processing centers level by level based on the delivery progress of each event processing center on the respective blockchain event stream. A delivery progress of a parent event processing center on a blockchain event stream of the parent event processing center is greater than a delivery progress of a child event processing center of the parent event processing center on a blockchain event stream the child event processing center. That is, a location of a blockchain event that is being delivered and processed by the parent event processing center in the blockchain event stream is newer than a location of a blockchain event that is being delivered and processed by the child event processing center in the blockchain event stream. For example, the delivery progress of the parent event processing center is block 1001, and the delivery progress of the child event processing center is block 1000.

[0063] Each event processing center obtains the blockchain event stream from the node device, and delivers the blockchain event stream to each trigger of the event processing center. Therefore, the delivery progress of each event processing center on the respective blockchain event stream is related to a creation time of the event processing center, a start or initial subscription location of the event processing center, and an average push speed of several triggers included in the event processing center.

[0064] In actual service use, because a push speed of a trigger may be affected by factors such as a network communication status between an event processing center and a service system corresponding to the trigger, the push speed of the trigger may change significantly, so that a difference among push speeds of a plurality of triggers included in the event processing center exceeds a predetermined threshold.

[0065] In an illustrative implementation, each event processing center can calculate a push speed of each trigger included in the event processing center on the respective blockchain event stream. As shown in FIG. 4B, if a difference between a push speed of at least one trigger, for example, triggers 3 and 4, in event processing center A and a speed of a trigger with a highest push speed is greater than the predetermined first threshold, after receiving a report, from the event processing center, of push speeds or a difference among push speeds of the triggers included in the event processing center, the control component can send an instruction for establishing a new event processing center and a trigger movement instruction, to establish new event processing center C between event processing center A and child event processing center B of event processing center A, and move the at least one trigger, for example, triggers 3 and 4, to new event processing center C to continue to process the blockchain event stream. In this case, an initial delivery progress of new event processing center C can be the same as a delivery progress of event processing center A. However, because the push speeds of triggers 3 and 4 are relatively low, after a specific time, the delivery progress of event processing center C is less than the delivery progress of event processing center A.

[0066] In the implementation above, new child event processing center C is established for event processing center A, and triggers 3 and 4 having push speeds that are different from a maximum, e.g., the highest, push speed by an amount greater than the first threshold are moved to new child event processing center C. It can be inferred that, in an illustrative implementation, the control component can further establish a new parent event processing center for event processing center A, and triggers 1 and 2 having push speeds that are different from a minimum, e.g., the lowest, push speed by an amount greater than the first threshold can be moved to the new parent event processing center. A specific process is similar to the implementation above. Details are omitted herein for simplicity.

[0067] It should be noted that, in FIGS. 4A, 4B, 4C and FIGS. 5A, 5B, 5C in the present specification, a service system corresponding to the trigger is omitted. Because a trigger condition of a service system connected to a trigger is set in the trigger, in some implementations, moving the trigger from one event processing center to another event processing center in each implementation of the present specification includes moving an event push service provided by the service system corresponding to the trigger from one event processing center to another event processing center.

[0068] The process above can be referred to as "split" of an event processing center. A push speed of each trigger in the distributed event processing centers is monitored, and the corresponding "split" process is executed, so that a plurality of triggers in each event processing center have comparable speeds, e.g., a speed difference does not exceed the predetermined threshold. However, due to a network status and other factors, although the plurality of triggers in each event processing center have comparable speeds, at a certain moment, an average speed of triggers included in a parent event processing center may be still less than an average speed of triggers included in a child event processing center of the parent event processing center. After a period of event processing, a delivery progress of the parent event processing center on a blockchain event stream of the parent event processing center may be less than a delivery progress of the child event processing center of the parent event processing center.

[0069] The control component can monitor in real time or obtain the delivery progress of each event processing center in the distributed event processing centers at an interval of a predetermined cycle. In an illustrative implementation, as shown in FIG. 4C, for two adjacent event processing centers A and C, if a second delivery progress of child event processing center C on a blockchain event stream of child event processing center C is not less than a first delivery progress of parent event processing center A on a blockchain event stream of parent event processing center A, the control component can move all triggers 3 and 4 in child event processing center C to the parent event processing center, and delete child event processing center C from the sequence among the distributed event processing centers.

[0070] The process above can be considered as a "combination" of event processing centers. In the combination process, the number of event processing centers included in the distributed event processing centers is reduced, and network traffic overheads of the distributed event processing centers are effectively reduced. In addition, a plurality of event processing centers are combined, so that delivery progresses in the sequence among the distributed event processing centers can be in descending order.

[0071] After child event processing center C and parent event processing center A are combined, the control component can continue to monitor push speeds or a difference among push speeds of all triggers included in new parent event processing center A obtained after the combination. If a difference between a push speed of at least one trigger and a speed of a trigger with a highest push speed is greater than the predetermined threshold, "split" of the event processing center should continue to be executed, to establish a new event processing center between event processing center A and child event processing center B of event processing center A, and move the at least one trigger to the new event processing center to process the blockchain event stream.

[0072] The control component can monitor the delivery progress of each event processing center in the distributed event processing centers, and execute the corresponding "combination" process, to establish, based on the delivery progress of each event processing center, a sequence among the distributed event processing centers with delivery progresses that are in descending order or in ascending order. The control component monitors the difference among the push speeds of all the triggers in each event processing center, and executes the corresponding "split" process, to ensure that all the triggers in each event processing center have comparable push speeds. Therefore, when each event processing center actually pushes blockchain events to each service system, through continuous "split" and "combination," a sequence among the distributed event processing centers can be established, where each event processing center includes several triggers with comparable speeds and delivery progresses on the blockchain event stream are in descending order or in ascending order. This improves blockchain event push efficiency, and saves network traffic of the distributed event processing centers.

[0073] In an illustrative implementation, to further reduce network traffic overheads of the distributed event processing centers, and facilitate combination of more event processing centers, when the control component monitors in real time or obtains the delivery progress of each event processing center in the distributed event processing centers at an interval of a predetermined cycle, as shown in FIG. 4C, for two adjacent event processing centers A and C, if the second delivery progress of child event processing center C is less than the first delivery progress of parent event processing center A, and a difference between the second delivery progress and the first delivery progress is less than a predetermined second threshold, for example, less than a unit threshold (such as ten transactions) within a predetermined time (such as 3 minutes), parent event processing center A is suspended from delivering the blockchain event stream to each trigger of parent event processing center A. In this case, child event processing center C continues to deliver and push the blockchain event stream. When the second delivery progress catches up the first delivery progress, e.g., when the second delivery progress becomes not less than the first delivery progress, the "combination" process described in the implementation above can be triggered. That is, all triggers 3 and 4 included in

child event processing center C are moved to parent event processing center A, and child event processing center C is removed. This implementation sets no specific limitation on a restart occasion of parent event processing center A obtained after the combination. For example, after triggers 3 and 4 are moved, or when a suspension instruction of the control component on parent event processing center A expires, parent event processing center A obtained after the combination can be restarted to deliver the blockchain event stream.

[0074] In an illustrative implementation, when an event processing center in the sequence among the distributed event processing centers does not have any trigger, for example, all service systems originally corresponding to the event processing center stop blockchain event subscription, all triggers corresponding to the service systems are removed, and subscription combination also needs to be performed. In essence, the event processing center is removed.

[0075] In the following implementations, the control component is disposed in each event processing center of the distributed event processing centers, and therefore, distributed control components of event processing centers are established.

[0076] As shown in FIG. 5A, for ease of distributed management, the distributed control components can establish a chained sequence among the distributed event processing centers by sorting the distributed event processing centers level by level based on the delivery progress of each event processing center on the respective blockchain event stream. A delivery progress of a parent event processing center on a blockchain event stream of the parent event processing center is greater than a delivery progress of a child event processing center of the parent event processing center on a blockchain event stream of the child event processing center, and each event processing center maintains a connection to an adjacent event processing center.

[0077] Each event processing center obtains the blockchain event stream from the node device, and delivers the blockchain event stream to each trigger of the event processing center. Therefore, the delivery progress of each event processing center on the respective blockchain event stream is related to a creation time of the event processing center, an initial or start subscription location, and an average push speed of several triggers included in the event processing center. The delivery progress on the respective blockchain event stream can be represented as a location, in the blockchain event stream, of a newest blockchain event delivered by the event processing center (or the trigger included in the event processing center). For example, a delivery progress of a certain event processing center is a block with a block height of 1000, or a delivery progress of a certain event processing center is a transaction that is in a block with a block height of 1000 and that has a serial number of 10.

[0078] In actual service use, because a push speed of a trigger may be affected by factors such as a network communication status between an event processing center and a service system corresponding to the trigger, the push speed of the trigger may change significantly, so that a difference among push speeds of a plurality of triggers included in the event processing center exceeds a predetermined threshold.

[0079] In an illustrative implementation, each event processing center can calculate a push speed of each trigger included in the event processing center on the respective blockchain event stream. As shown in FIG. 5B, if a difference between a push speed of at least one trigger, for example, triggers 3 and 4, in event processing center A and a speed of a trigger with a highest push speed is greater than the predetermined first threshold, a distributed control component configured for event processing center A can send an instruction for establishing a new event processing center and a trigger movement instruction, to establish new event processing center C between event processing center A and child event processing center B of event processing center A, and cooperate with a distributed control component configured for new event processing center C to move the at least one trigger, for example, triggers 3 and 4, to new event processing center C to continue to deliver and process the blockchain event stream.

[0080] Because a trigger condition of a service system connected to a trigger is set in the trigger, in some implementations, moving the trigger from one event processing center to another event processing center in each implementation in the present specification includes moving an event push service provided by the service system corresponding to the trigger from one event processing center to another event processing center.

[0081] The process above can be referred to as "split" of an event processing center. The control component configured for each event processing center monitors a push speed of each trigger in the event processing center, and executes the corresponding "split" process, so that a plurality of triggers in each event processing center have comparable speeds, e.g., a speed difference does not exceed the predetermined threshold. However, due to a network status and other factors, although the plurality of triggers in each event processing center have comparable speeds, at a certain moment, an average speed of triggers included in a parent event processing center may be still less than an average speed of triggers included in a child event processing center of the parent event processing center. After a period of event processing, a delivery progress of the parent event processing center on a blockchain event stream of the parent event processing center may be less than a delivery progress of the child event processing center of the parent event processing center.

[0082] In an illustrative implementation, as shown in FIG. 5C, each child event processing center can report a delivery progress of the child event processing center

to a parent event processing center of the child event processing center at an interval of a predetermined cycle. If a control component of parent event processing center A learns, through comparison, that a second delivery progress of child event processing center C on a blockchain event stream of child event processing center C is not less than a first delivery progress of parent event processing center A on a blockchain event stream of parent event processing center A, control components of parent event processing center A and child event processing center C can cooperate with each other in processing, to move all triggers 3 and 4 in child event processing center C to parent event processing center A, and delete child event processing center C from the sequence among the distributed event processing centers. Afterwards, event processing center A serves as a parent event processing center of event processing center B, and receives a report of a delivery progress of event processing center B.

[0083] The process above can be considered as "combination" of event processing centers. In the combination process, the number of event processing centers included in the distributed event processing centers is reduced, and network traffic overheads of the distributed event processing centers are effectively reduced.

[0084] After child event processing center C and parent event processing center A are combined, the control component of newly generated distributed event processing center A can continue to monitor push speeds of all triggers included in the event processing center. If a difference between a push speed of at least one trigger and a speed of a trigger with a highest push speed is greater than the predetermined threshold, "split" of the event processing center can continue to be executed, to establish a new event processing center between event processing center A and child event processing center B of event processing center A, and move the at least one trigger to the new event processing center to process the blockchain event stream.

[0085] In the sequence among the distributed event processing centers above, a parent event processing center receives a report of a delivery progress of a child event processing center, and trigger the "combination" process when finding that the delivery progress of the child event processing center is not less than a delivery progress of the parent event processing center on a blockchain event stream of the parent event processing center, to establish, based on the delivery progress of each event processing center, a sequence among the distributed event processing centers with delivery progresses that are in descending order or in ascending order. Each event processing center monitors the difference between the push speeds of all the triggers in the event processing center, and executes the corresponding "split" process, to ensure that all the triggers in each event processing center have comparable push speeds. Therefore, when each event processing center actually pushes blockchain events to each service system, through continuous "split" and "combination," a sequence among the distributed event processing centers can be established, where each event processing center includes several triggers with comparable speeds and delivery progresses on the blockchain event stream are in descending order or in ascending order. This improves blockchain event push efficiency, and saves network traffic of the distributed event processing centers.

[0086] In an illustrative implementation, to further reduce network traffic overheads of the distributed event processing centers, and facilitate combination of more event processing centers, as shown in FIG. 5C, when the control component of parent event processing center A monitors in real time or obtains, at an interval of a predetermined cycle, a report that is of a delivery progress and that is sent by child event processing center C, if parent event processing center A learns that the second delivery progress of child event processing center C is less than the first delivery progress of parent event processing center A, and a difference between the second delivery progress and the first delivery progress is less than a predetermined second threshold, for example, less than a unit threshold (such as ten transactions) within a predetermined time (such as 3 minutes), the control component of parent event processing center A suspends a blockchain event stream delivery process of event processing center A. In this case, child event processing center C continues to deliver and push the blockchain event stream. When the second delivery progress catches up the first delivery progress, e.g., when the second delivery progress becomes not less than the first delivery progress, the "combination" process described in the implementation above can be triggered. That is, all triggers 3 and 4 included in child event processing center C are moved to parent event processing center A, and child event processing center C is removed. This implementation sets no specific limitation on a restart occasion of parent event processing center A obtained after the combination. For example, after triggers 3 and 4 are moved, or when a suspension instruction of the control component of parent event processing center A on parent event processing center A expires, parent event processing center A obtained after the combination can be restarted to deliver the blockchain event stream.

[0087] In an illustrative implementation, when an event processing center in the sequence among the distributed event processing centers does not have any trigger, the event processing center also needs to be combined with a parent event processing center of the event processing center, for example, all service systems originally corresponding to the event processing center stop blockchain event subscription. Correspondingly, all triggers corresponding to the service systems are removed. In this case, combining event processing centers is actually removing the event processing center. If the event processing center has no parent event processing center, the event processing center is directly removed, and a child

event processing center of the event processing center serves as a new highest parent event processing center located at an endpoint of the sequence among the distributed event processing centers.

[0088] It can be learned from the implementations that, regardless of whether the control component of the distributed event processing centers includes centralized control components or distributed control components, the sequence among the distributed event processing centers with delivery progresses that are in descending order can be established based on the delivery progress of each processing center on the respective blockchain event stream. When receiving a subscription requirement of a new service system, the node device can notify the control component to create a new event processing center in the sequence among distributed event processing centers to connect to the new service system. If the subscription requirement specifies start/initial location information of a subscribed blockchain event stream, a new trigger can be created in the new event processing center. The trigger declares a start or initial location of the blockchain event stream subscribed to by the new service system corresponding to the trigger, and the new event processing center is inserted into the sequence as a parent node of a first event processing center having a delivery progress that is less than the start or initial location. After the insertion ends, a new trigger included in the newly inserted event processing center gradually participates in an event processing center including a trigger with a push speed comparable to that of the trigger based on the combination or split process of the blockchain event processing centers in the one or more implementations.

[0089] Corresponding to the process implementation, an implementation of the present specification further provides a blockchain event processing apparatus 60. The apparatus 60 can be implemented by using software, or can be implemented by using hardware or a combination of software and hardware. Software implementation is used as an example. As a logical apparatus, the apparatus is formed by reading a corresponding computer program instruction to a memory for running by a central process unit (CPU) of a device in which the apparatus is located. In terms of hardware, in addition to the CPU, the memory, and the storage device shown in FIG. 7, the device in which the apparatus is located usually further includes other hardware such as a chip used for sending/receiving a radio signal, and/or other hardware such as a board used for implementing a network communication function.

[0090] As shown in FIG. 6, the present specification further provides a blockchain event processing apparatus 60, applied to a control component of distributed event processing centers connected to a node device of a blockchain network. The distributed event processing centers obtain respective blockchain event streams from the node device, and deliver the obtained respective blockchain event streams to respective triggers included in the distributed event processing centers, to push a blockchain event included in the blockchain event streams to a service system corresponding to a trigger of the triggers when the blockchain event meets a trigger condition in the trigger.

[0091] The apparatus 60 includes: an acquisition unit 602, configured to obtain push speeds of a plurality of triggers included in an event processing center of the distributed event processing centers; and an establishment unit 604, configured to: if a difference among the push speeds of the plurality of triggers is greater than a predetermined first threshold, establish a new event processing center, and move, to the new event processing center, a trigger having a push speed that is different from a highest push speed of the push speeds by an amount greater than the first threshold, or a trigger having a push speed that is different from a lowest push speed of the push speeds by an amount greater than the first threshold.

[0092] In an illustrative implementation, the apparatus 60 further includes: a sorting unit 606, configured to establish a sequence among the distributed event processing centers by sorting the distributed event processing centers level by level based on a delivery progress of each event processing center on a respective blockchain event stream, where a delivery progress of a parent event processing center on a blockchain event stream of the parent event processing center is greater than a delivery progress of a child event processing center of the parent event processing center on a blockchain event stream of the child event processing center.

[0093] In an illustrative implementation, the establishment unit 604 is further configured to: establish a new child event processing center for the event processing center, and move, to the new child event processing center, the trigger having a push speed that is different from the highest push speed by an amount greater than the first threshold; or establish a new parent event processing center for the event processing center, and move, to the new parent event processing center, the trigger having a push speed that is different from the lowest push speed by an amount greater than the first threshold.

[0094] In an illustrative implementation, the acquisition unit 602 is further configured to obtain a delivery progress of each event processing center in the distributed event processing centers on a respective blockchain event stream; a movement unit 608 is configured to: if a second delivery progress of a child event processing center of a parent event processing center in the distributed event processing centers on a blockchain event stream of the child event processing center is not less than a first delivery progress of the parent event processing center on a blockchain event stream of the parent event processing center, move each trigger in the child event processing center to the parent event processing center; and a removal unit 610 is configured to remove the child event processing center.

[0095] In an illustrative implementation, the apparatus

60 further includes: a suspending unit 612, configured to: if the second delivery progress of the child event processing center is less than the first delivery progress of the parent event processing center, and a difference between the second delivery progress and the first delivery progress is less than a predetermined second threshold, suspend the parent event processing center from delivering the blockchain event stream obtained by the parent event processing center to each trigger of the parent event processing center, where the movement unit 608 is further configured to: when the second delivery progress becomes not less than the first delivery progress, move the trigger included in the child event processing center to the parent event processing center; and the removal unit 610 is further configured to remove the child event processing center; and a restart unit 614, configured to restart the parent event processing center to continue to deliver the blockchain event stream obtained by the parent event processing center to each trigger included in the parent event processing center.

[0096] In an illustrative implementation, the removal unit 610 is configured to remove an event processing center if the event processing center in the distributed event processing centers does not include any trigger.

[0097] In an illustrative implementation, the event processing center is a software development kit component coupled to the node device.

[0098] In an illustrative implementation, the establishment unit 604 is configured to create a new event processing center, the new event processing center including a new trigger, and the new trigger declaring a start or initial location of a blockchain event stream subscribed to by a service system corresponding to the new trigger; and the sorting unit 606 is configured to set the new event processing center as a parent event processing center of a first event processing center having a delivery progress that is less than the start or initial location.

[0099] In an illustrative implementation, the control component includes centralized control components, and the centralized control components are separately communicatively connected to the distributed event processing centers.

[0100] In an illustrative implementation, the control component includes distributed control components that are separately disposed in the distributed event processing centers, and each event processing center in the distributed event processing center sequence is communicatively connected to an adjacent event processing center.

[0101] For specific implementation processes of functions of units in the apparatus 60, reference can be made to the implementation process of the blockchain event processing method performed by the control component. For related parts, references can be made to parts of the method implementation descriptions. Details are omitted herein for simplicity.

[0102] The apparatus implementation described above is merely an example. The units described as separate parts can or cannot be physically separate, and parts displayed as units can or cannot be physical modules, can be located in one position, or can be distributed on a plurality of network modules. Some or all of the units or modules can be selected based on actual needs to achieve the objectives of the solutions of the present specification. A person of ordinary skill in the art can understand and implement the implementations of the present application without creative efforts.

[0103] The apparatus, unit, or module illustrated in the implementations can be implemented by computer chips, entities, or products having a certain function. A typical implementation device is a computer, and the computer can be a personal computer, a laptop computer, a cellular phone, a camera phone, a smartphone, a personal digital assistant, a media player, a navigation device, an email receiving and sending device, a game console, a tablet computer, a wearable device, or any combination of these devices.

[0104] Corresponding to the method implementation, an implementation of the present specification further provides a computer device. As shown in FIG. 7, the computer device includes a storage device and a processor. The storage device stores a computer program that can be run by the processor. When running the stored computer program, the processor performs the blockchain event processing method performed by the control component in the implementation of the present specification. For detailed descriptions of the blockchain event processing method performed by the control component, reference can be made to the content above. Details are omitted herein for simplicity.

[0105] The descriptions above are merely preferred implementations of the present specification, and are not intended to limit the present specification. Any modification, equivalent replacement, improvement, etc., made without departing from the spirit and principles of the present specification shall fall within the protection scope of the present specification.

[0106] The specification also include the below example implementations:

[0107] Example implementation 1: a blockchain event processing method, applied to a control component of distributed event processing centers coupled to a node device of a blockchain network, the distributed event processing centers obtaining respective blockchain event streams from the node device, and delivering the obtained respective blockchain event streams to respective triggers included in the distributed event processing centers, to push a blockchain event included in the blockchain event streams to a service system corresponding to a trigger of the triggers in response to the blockchain event meeting a trigger condition of the trigger, the method comprising: obtaining push speeds of a plurality of triggers included in an event processing center of the distributed event processing centers; and in response to a difference among the push speeds of the plurality of triggers being greater than a predetermined first thresh-

old, establishing a new event processing center, and moving, to the new event processing center, a trigger having a push speed that is different from a highest push speed of the push speeds by an amount greater than the first threshold or a trigger having a push speed that is different from a lowest push speed of the push speeds by an amount greater than the first threshold.

[0108] Example implementation 2: the method according to example implementation 1, further comprising: establishing a sequence among the distributed event processing centers by sorting the distributed event processing centers level by level based on a delivery progress of each event processing center on a respective blockchain event stream, wherein a delivery progress of a parent event processing center on a blockchain event stream of the parent event processing center is greater than a delivery progress of a child event processing center of the parent event processing center on a blockchain event stream of the child event processing center.

[0109] Example implementation 3: the method according to example implementation 2, wherein the establishing the new event processing center, and moving, to the new event processing center, the trigger having a push speed that is different from the highest push speed by an amount greater than the first threshold or the trigger having a push speed that is different from the lowest push speed by an amount greater than the first threshold includes: establishing a new child event processing center for the event processing center, and moving, to the new child event processing center, the trigger having a push speed that is different from the highest push speed by an amount greater than the first threshold; or establishing a new parent event processing center for the event processing center, and moving, to the new parent event processing center, the trigger having a push speed that is different from the lowest push speed by an amount greater than the first threshold.

[0110] Example implementation 4: the method according to example implementation 2, further comprising: obtaining a delivery progress of each event processing center in the distributed event processing centers on a respective blockchain event stream; and in response to a second delivery progress of a child event processing center of a parent event processing center in the distributed event processing centers on a blockchain event stream of the child event processing center is not less than a first delivery progress of the parent event processing center on a blockchain event stream of the parent event processing center, moving each trigger in the child event processing center to the parent event processing center, and removing the child event processing center.

[0111] Example implementation 5: the method according to example implementation 4, further comprising: in response to the second delivery progress of the child event processing center being less than the first delivery progress of the parent event processing center, and a difference between the second delivery progress and the first delivery progress being less than a predetermined second threshold, suspending the parent event processing center from delivering the blockchain event stream obtained by the parent event processing center to each trigger of the parent event processing center; in response to the second delivery progress becoming not less than the first delivery progress, moving the trigger included in the child event processing center to the parent event processing center, and removing the child event processing center; and restarting the parent event processing center to continue to deliver the blockchain event stream obtained by the parent event processing center to each trigger included in the parent event processing center.

[0112] Example implementation 6: the method according to example implementation 2, 3, 4, or 5, further comprising: removing an event processing center in response to the event processing center in the distributed event processing centers does not include any trigger.

[0113] Example implementation 7: the method according to example implementation 1, wherein the event processing center is a software development kit component coupled to the node device.

[0114] Example implementation 8: the method according to example implementation 2, further comprising: creating a new event processing center, the new event processing center including a new trigger, and the new trigger declaring a start or initial location of a blockchain event stream subscribed to by a service system corresponding to the new trigger; and setting the new event processing center as a parent event processing center of a first event processing center having a delivery progress that is less than the start or initial location.

[0115] Example implementation 9: the method according to example implementation 2, wherein the control component includes centralized control components, and the centralized control components are separately communicatively coupled to the distributed event processing centers.

[0116] Example implementation 10: the method according to example implementation 2, wherein the control component includes distributed control components that are separately disposed in the distributed event processing centers, and each event processing center in the sequence of the distributed event processing centers is communicatively coupled to an adjacent event processing center in the sequence.

[0117] Example implementation 11: a blockchain event processing apparatus, applied to a control component of distributed event processing centers coupled to a node device of a blockchain network, the distributed event processing centers obtaining respective blockchain event streams from the node device, and delivering the obtained respective blockchain event streams to respective triggers included in the distributed event processing centers, to push a blockchain event included in the blockchain event streams to a service system corresponding to a trigger of the triggers in response to the blockchain event meeting a trigger condition in the trigger, the apparatus comprising: an acquisition unit, con-

figured to obtain push speeds of a plurality of triggers included in an event processing center of the distributed event processing centers; and an establishment unit, configured to: in response to a difference among the push speeds of the plurality of triggers being greater than a predetermined first threshold, establish a new event processing center, and move, to the new event processing center, a trigger having a push speed that is different from a highest push speed of the push speeds by an amount greater than the first threshold, or a trigger having a push speed that is different from a lowest push speed of the push speeds by an amount greater than the first threshold.

[0118] Example implementation 12: the apparatus according to example implementation 11, further comprising: a sorting unit, configured to establish a sequence among the distributed event processing centers by sorting the distributed event processing centers level by level based on a delivery progress of each event processing center on a respective blockchain event stream, wherein a delivery progress of a parent event processing center on a blockchain event stream of the parent event processing center is greater than a delivery progress of a child event processing center of the parent event processing center on a blockchain event stream of the child event processing center.

[0119] Example implementation 13: the apparatus according to example implementation 12, wherein the establishment unit is further configured to: establish a new child event processing center for the event processing center, and move, to the new child event processing center, the trigger having a push speed that is different from the highest push speed by an amount greater than the first threshold; or establish a new parent event processing center for the event processing center, and move, to the new parent event processing center, the trigger having a push speed that is different from the lowest push speed by an amount greater than the first threshold.

[0120] Example implementation 14: the apparatus according to example implementation 12, wherein the acquisition unit is further configured to obtain a delivery progress of each event processing center in the distributed event processing centers on a respective blockchain event stream; a movement unit is configured to: in response to a second delivery progress of a child event processing center of a parent event processing center in the distributed event processing centers on a blockchain event stream of the child event processing center being not less than a first delivery progress of the parent event processing center on a blockchain event stream of the parent event processing center, move each trigger in the child event processing center to the parent event processing center; and a removal unit is configured to remove the child event processing center.

[0121] Example implementation 15: the apparatus according to example implementation 14, further comprising: a suspending unit, configured to: in response to the second delivery progress of the child event processing center being less than the first delivery progress of the parent event processing center, and a difference between the second delivery progress and the first delivery progress being less than a predetermined second threshold, suspend the parent event processing center from delivering the blockchain event stream obtained by the parent event processing center to each trigger of the parent event processing center, wherein the movement unit is further configured to: in response to the second delivery progress becoming not less than the first delivery progress, move the trigger included in the child event processing center to the parent event processing center; and the removal unit is further configured to remove the child event processing center; and a restart unit, configured to restart the parent event processing center to continue to deliver the blockchain event stream obtained by the parent event processing center to each trigger included in the parent event processing center.

[0122] Example implementation 16: the apparatus according to any one of example implementations 12 to 15, wherein the removal unit is configured to remove an event processing center in response to the event processing center in the distributed event processing centers not including any trigger.

[0123] Example implementation 17: the apparatus according to example implementation 11, wherein the event processing center is a software development kit component coupled to the node device.

[0124] Example implementation 18: the apparatus according to example implementation 12, wherein the establishment unit is configured to create a new event processing center, the new event processing center including a new trigger, and the new trigger declaring a start or initial location of a blockchain event stream subscribed to by a service system corresponding to the new trigger; and the sorting unit is configured to set the new event processing center as a parent event processing center of a first event processing center having a delivery progress that is less than the start or initial location.

[0125] Example implementation 19: the apparatus according to example implementation 12, wherein the control component includes centralized control components, and the centralized control components are separately communicatively coupled to the distributed event processing centers.

[0126] Example implementation 20: the apparatus according to example implementation 12, wherein the control component includes distributed control components that are separately disposed in the distributed event processing centers, and each event processing center in the sequence of the distributed event processing centers is communicatively coupled to an adjacent event processing center in the sequence.

[0127] Example implementation 21: a computer device, comprising a storage device and a processor, wherein the storage device stores a computer program that can be run by the processor, and when running the computer program, the processor performs the method

according to any one of example implementations 1 to 10.

[0128] In a typical configuration, a computing device includes one or more processors (CPUs), an input/output interface, a network interface, and a memory.

[0129] The memory can include a non-persistent memory, a random access memory (RAM), a non-volatile memory, and/or another form that are in a computer readable medium, for example, a read-only memory (ROM) or a flash memory (flash RAM). The memory is an example of the computer readable medium.

[0130] The computer readable medium includes persistent, non-persistent, movable, and unmovable media that can store information by using any method or technology. The information can be a computer readable instruction, a data structure, a program module, or other data.

[0131] Examples of the computer storage medium include but are not limited to a phase change random access memory (PRAM), a static random access memory (SRAM), a dynamic random access memory (DRAM), another type of RAM, a ROM, an electrically erasable programmable read-only memory (EEPROM), a flash memory or another memory technology, a compact disc read-only memory (CD-ROM), a digital versatile disc (DVD) or another optical storage, a cassette magnetic tape, a magnetic tape/magnetic disk storage, another magnetic storage device, or any other non-transmission medium. The computer storage medium can be used to store information accessible by the computing device. Based on the definition in the present specification, the computer readable medium does not include transitory media such as a modulated data signal and carrier.

[0132] It should also be noted that terms "include," "comprise" or any other variant thereof is intended to cover non-exclusive inclusion, so that processes, methods, products or devices that include a series of elements include not only those elements, but also include other elements that are not explicitly listed, or elements inherent in such processes, methods, products or devices. An element described by "includes a ..." further includes, without more constraints, another identical element in the process, method, product, or device that includes the element.

[0133] A person skilled in the art should understand that the implementations of the present specification can be provided as methods, systems, or computer program products. Therefore, the implementations of the present specification can take a form of complete hardware implementations, complete software implementations, or implementations combining software and hardware. Further, the implementations of the present specification can take a form of computer program products implemented on one or more computer-usable storage media (including but not limited to a disk storage device, CD-ROM, and an optical storage device) containing computer-usable program code.

Claims

1. A blockchain event processing method, applied to a control component of distributed event processing centers coupled to a node device of a blockchain network, the distributed event processing centers obtaining respective blockchain event streams from the node device, and delivering the obtained respective blockchain event streams to respective triggers included in the distributed event processing centers, to push a blockchain event included in the blockchain event streams to a service system corresponding to a trigger of the triggers in response to the blockchain event meeting a trigger condition of the trigger, the method comprising:

   obtaining push speeds of a plurality of triggers included in an event processing center of the distributed event processing centers; and

   in response to a difference among the push speeds of the plurality of triggers being greater than a predetermined first threshold, establishing a new event processing center, and moving, to the new event processing center, a trigger having a push speed that is different from a highest push speed of the push speeds by an amount greater than the first threshold or a trigger having a push speed that is different from a lowest push speed of the push speeds by an amount greater than the first threshold.

2. The method according to claim 1, further comprising: establishing a sequence among the distributed event processing centers by sorting the distributed event processing centers level by level based on a delivery progress of each event processing center on a respective blockchain event stream, wherein a delivery progress of a parent event processing center on a blockchain event stream of the parent event processing center is greater than a delivery progress of a child event processing center of the parent event processing center on a blockchain event stream of the child event processing center.

3. The method according to claim 2, wherein the establishing the new event processing center, and moving, to the new event processing center, the trigger having a push speed that is different from the highest push speed by an amount greater than the first threshold or the trigger having a push speed that is different from the lowest push speed by an amount greater than the first threshold includes:

   establishing a new child event processing center for the event processing center, and moving, to the new child event processing center, the trigger having a push speed that is different from the highest push speed by an amount greater

than the first threshold; or

establishing a new parent event processing center for the event processing center, and moving, to the new parent event processing center, the trigger having a push speed that is different from the lowest push speed by an amount greater than the first threshold.

4. The method according to claim 2, further comprising:

obtaining a delivery progress of each event processing center in the distributed event processing centers on a respective blockchain event stream; and

in response to a second delivery progress of a child event processing center of a parent event processing center in the distributed event processing centers on a blockchain event stream of the child event processing center is not less than a first delivery progress of the parent event processing center on a blockchain event stream of the parent event processing center, moving each trigger in the child event processing center to the parent event processing center, and removing the child event processing center.

5. The method according to claim 4, further comprising:

in response to the second delivery progress of the child event processing center being less than the first delivery progress of the parent event processing center, and a difference between the second delivery progress and the first delivery progress being less than a predetermined second threshold, suspending the parent event processing center from delivering the blockchain event stream obtained by the parent event processing center to each trigger of the parent event processing center;

in response to the second delivery progress becoming not less than the first delivery progress, moving the trigger included in the child event processing center to the parent event processing center, and removing the child event processing center; and

restarting the parent event processing center to continue to deliver the blockchain event stream obtained by the parent event processing center to each trigger included in the parent event processing center.

6. The method according to claim 2, 3, 4, or 5, further comprising:

removing an event processing center in response to the event processing center in the distributed event processing centers does not include any trigger.

7. The method according to claim 1, wherein the event processing center is a software development kit component coupled to the node device.

8. The method according to claim 2, further comprising:

creating a new event processing center, the new event processing center including a new trigger, and the new trigger declaring a start or initial location of a blockchain event stream subscribed to by a service system corresponding to the new trigger; and

setting the new event processing center as a parent event processing center of a first event processing center having a delivery progress that is less than the start or initial location.

9. The method according to claim 2, wherein the control component includes centralized control components, and the centralized control components are separately communicatively coupled to the distributed event processing centers.

10. The method according to claim 2, wherein the control component includes distributed control components that are separately disposed in the distributed event processing centers, and each event processing center in the sequence of the distributed event processing centers is communicatively coupled to an adjacent event processing center in the sequence.

11. A blockchain event processing apparatus, applied to a control component of distributed event processing centers coupled to a node device of a blockchain network, the distributed event processing centers obtaining respective blockchain event streams from the node device, and delivering the obtained respective blockchain event streams to respective triggers included in the distributed event processing centers, to push a blockchain event included in the blockchain event streams to a service system corresponding to a trigger of the triggers in response to the blockchain event meeting a trigger condition in the trigger,

the apparatus comprising a plurality of modules for performing the method of any of claims 1 to 10.

12. A computer device, comprising a storage device and a processor, wherein the storage device stores a computer program that can be run by the processor, and when running the computer program, the processor performs the method according to any one of claims 1 to 10.

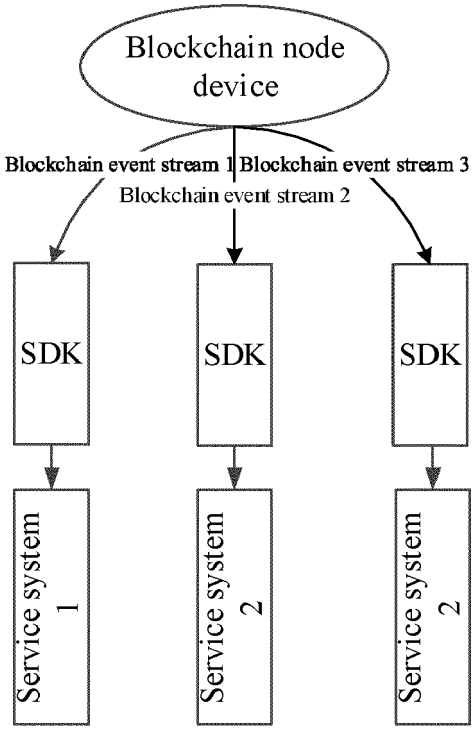
Blockchain node device
Blockchain event stream 1
Blockchain event stream 2
Blockchain event stream 3
SDK
SDK
SDK
Service system 1
Service system 2
Service system 2

FIG. 1A

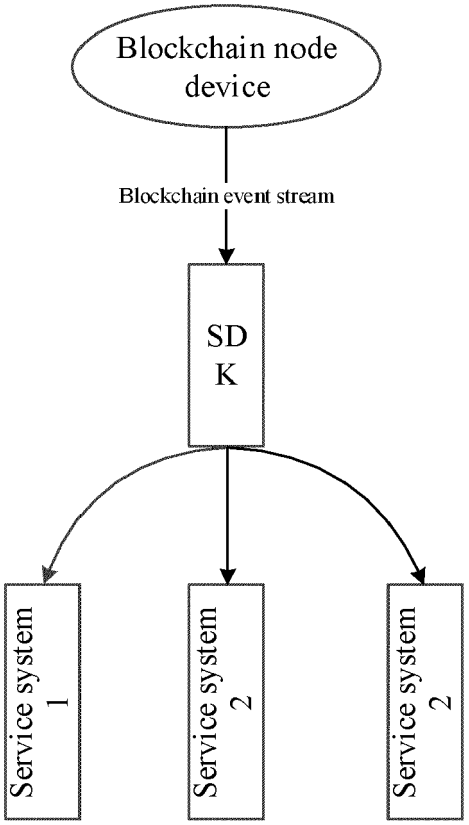
Blockchain node device
Blockchain event stream
SD K
Service system 1
Service system 2
Service system 2

FIG. 1B

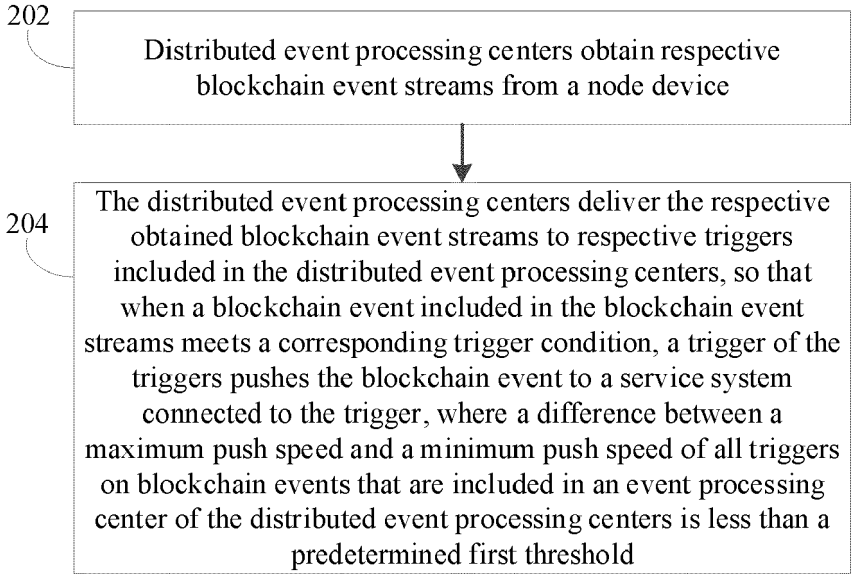
202
Distributed event processing centers obtain respective blockchain event streams from a node device
204
The distributed event processing centers deliver the respective obtained blockchain event streams to respective triggers included in the distributed event processing centers, so that when a blockchain event included in the blockchain event streams meets a corresponding trigger condition, a trigger of the triggers pushes the blockchain event to a service system connected to the trigger, where a difference between a maximum push speed and a minimum push speed of all triggers on blockchain events that are included in an event processing center of the distributed event processing centers is less than a predetermined first threshold

FIG. 2

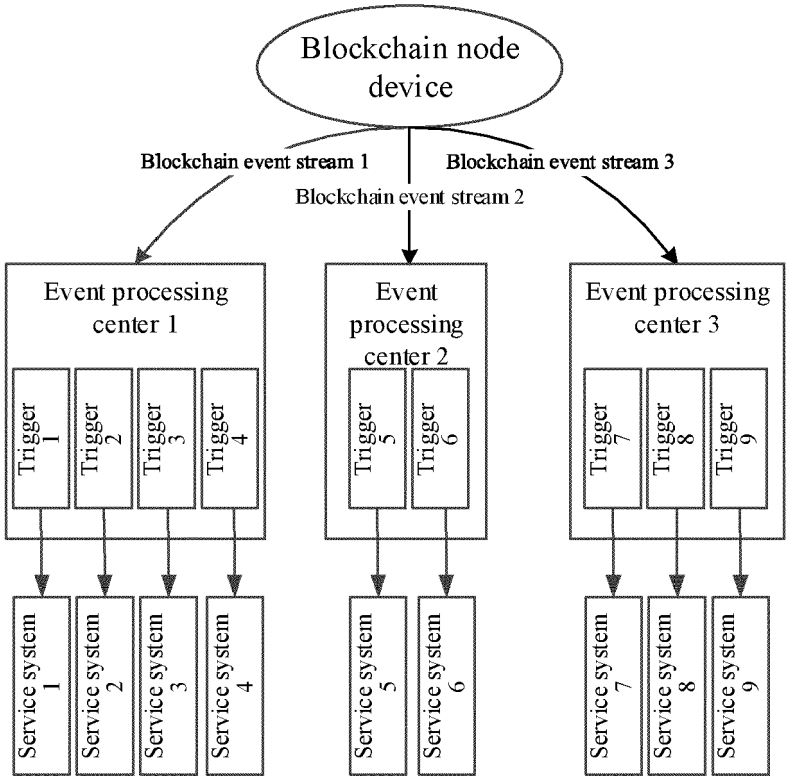
Blockchain node device
Blockchain event stream 1
Blockchain event stream 2
Blockchain event stream 3
Event processing center 1
Event processing center 2
Event processing center 3
Trigger 1
Trigger 2
Trigger 3
Trigger 4
Trigger 5
Trigger 6
Trigger 7
Trigger 8
Trigger 9
Service system 1
Service system 2
Service system 3
Service system 4
Service system 5
Service system 6
Service system 7
Service system 8
Service system 9

FIG. 3

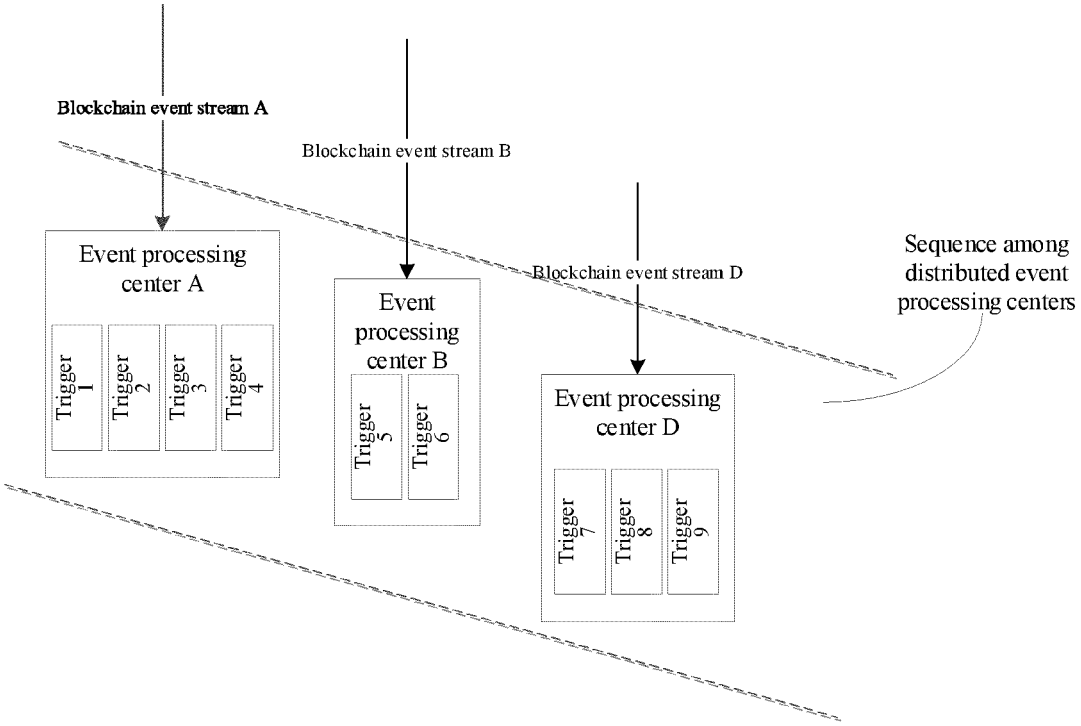
Blockchain event stream A
Blockchain event stream B
Blockchain event stream D
Event processing center A
Trigger 1
Trigger 2
Trigger 3
Trigger 4
Event processing center B
Trigger 5
Trigger 6
Event processing center D
Trigger 7
Trigger 8
Trigger 9
Sequence among distributed event processing centers

FIG. 4A

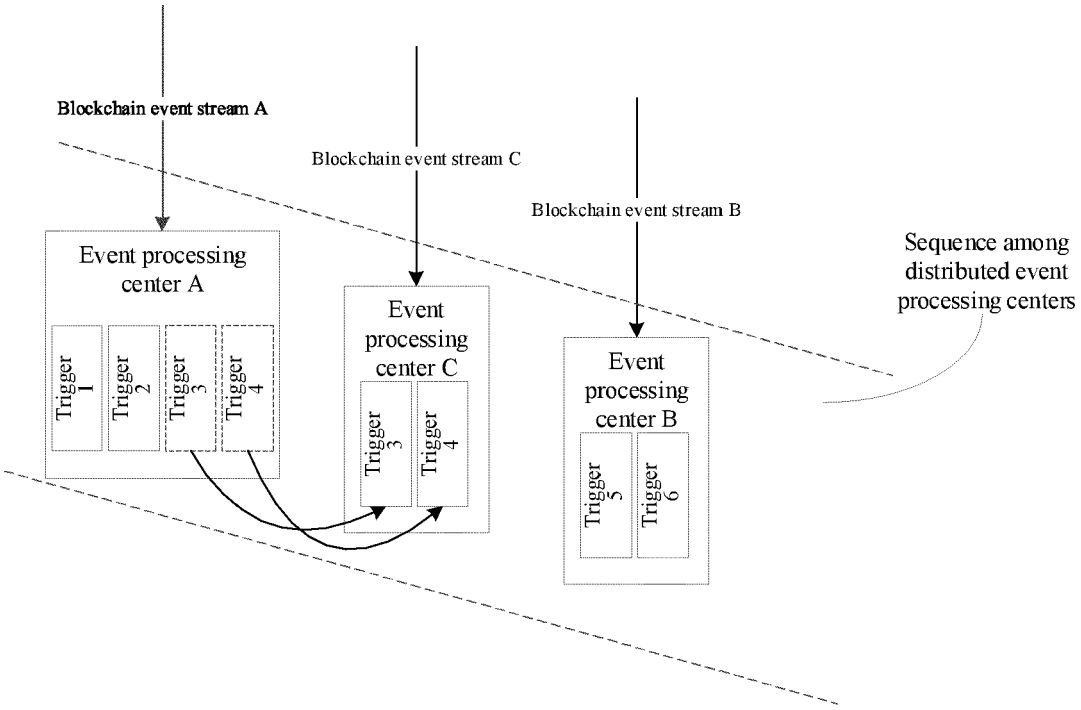
Blockchain event stream A
Blockchain event stream C
Blockchain event stream B
Event processing center A
Trigger 1
Trigger 2
Trigger 3
Trigger 4
Event processing center C
Trigger 3
Trigger 4
Event processing center B
Trigger 5
Trigger 6
Sequence among distributed event processing centers

FIG. 4B

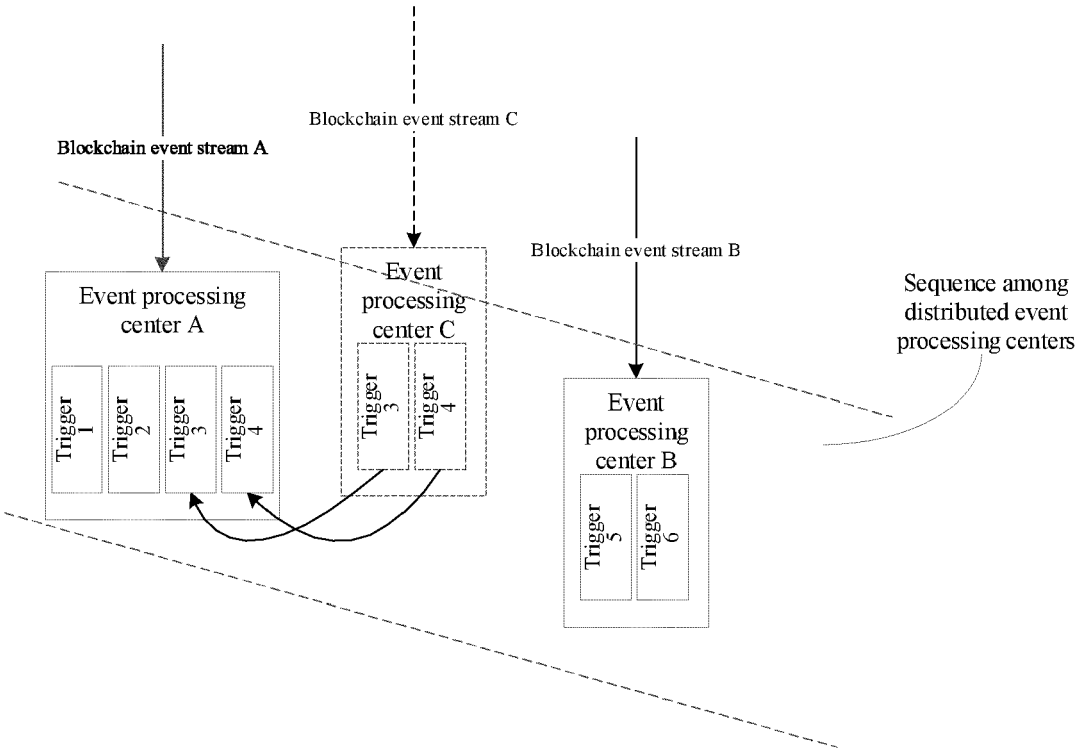
Blockchain event stream A
Blockchain event stream C
Blockchain event stream B
Event processing center A
Trigger 1
Trigger 2
Trigger 3
Trigger 4
Event processing center C
Trigger 3
Trigger 4
Event processing center B
Trigger 5
Trigger 6
Sequence among distributed event processing centers

FIG. 4C

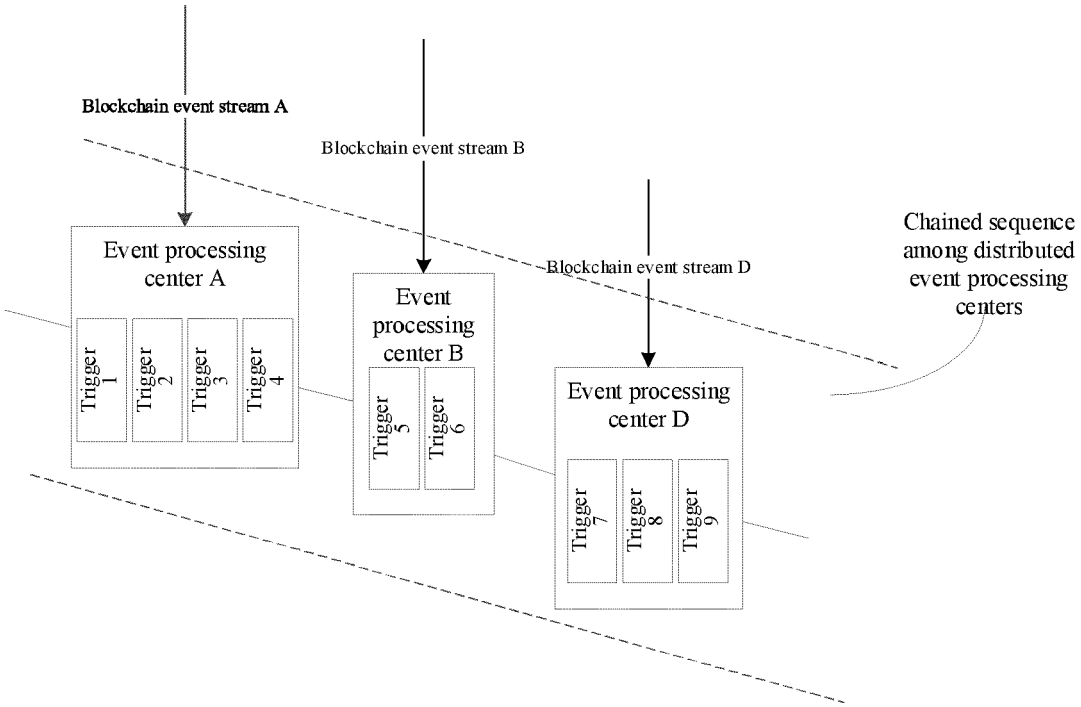
Blockchain event stream A
Blockchain event stream B
Blockchain event stream D
Event processing center A
Trigger 1
Trigger 2
Trigger 3
Trigger 4
Event processing center B
Trigger 5
Trigger 6
Event processing center D
Trigger 7
Trigger 8
Trigger 9
Chained sequence among distributed event processing centers

FIG. 5A

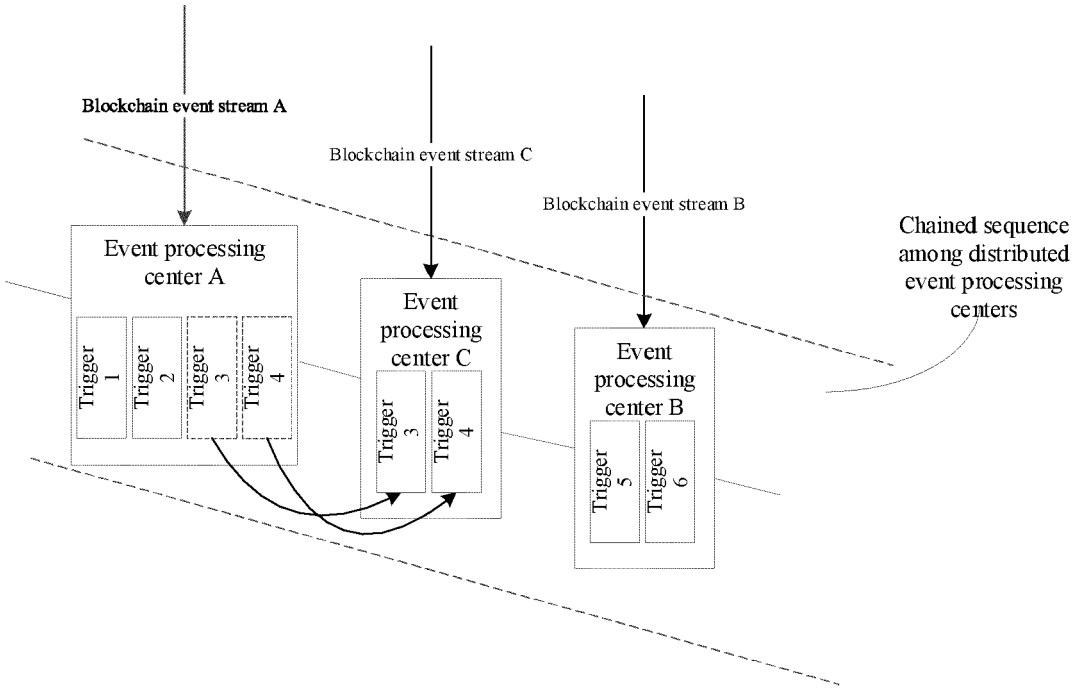
Blockchain event stream A
Blockchain event stream C
Blockchain event stream B
Chained sequence among distributed event processing centers
Event processing center A
Trigger 1
Trigger 2
Trigger 3
Trigger 4
Event processing center C
Trigger 3
Trigger 4
Event processing center B
Trigger 5
Trigger 6

FIG. 5B

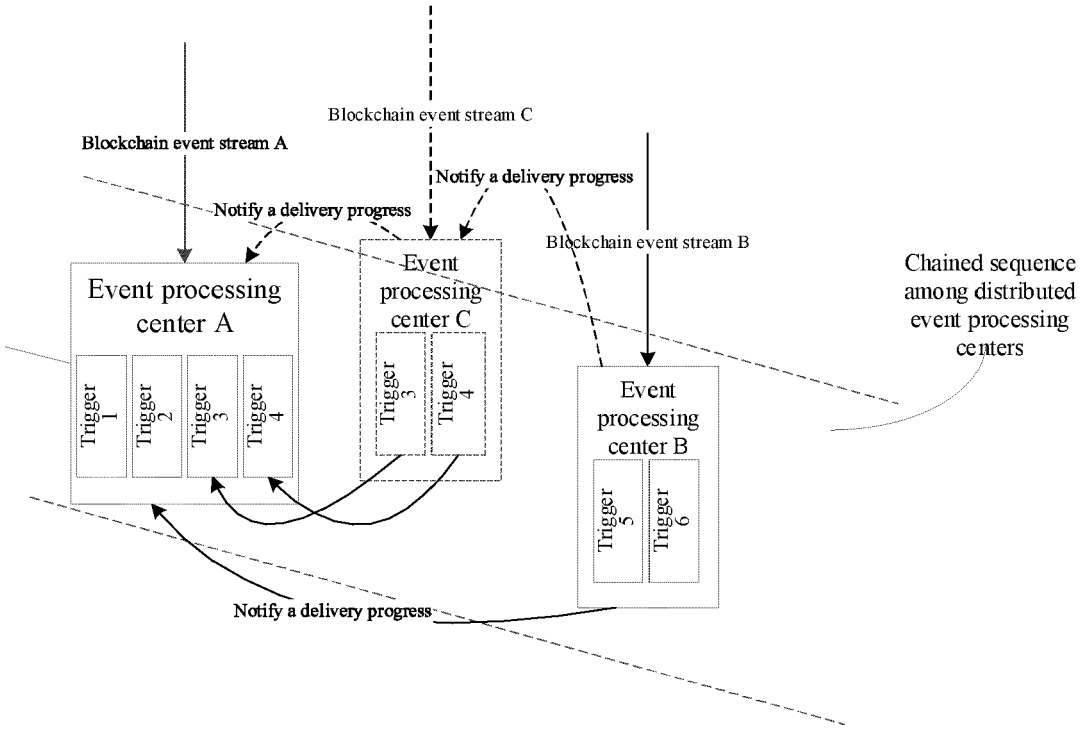
Blockchain event stream C
Blockchain event stream A
Notify a delivery progress
Notify a delivery progress
Blockchain event stream B
Chained sequence among distributed event processing centers
Event processing center A
Trigger 1
Trigger 2
Trigger 3
Trigger 4
Event processing center C
Trigger 3
Trigger 4
Event processing center B
Trigger 5
Trigger 6
Notify a delivery progress

FIG. 5C

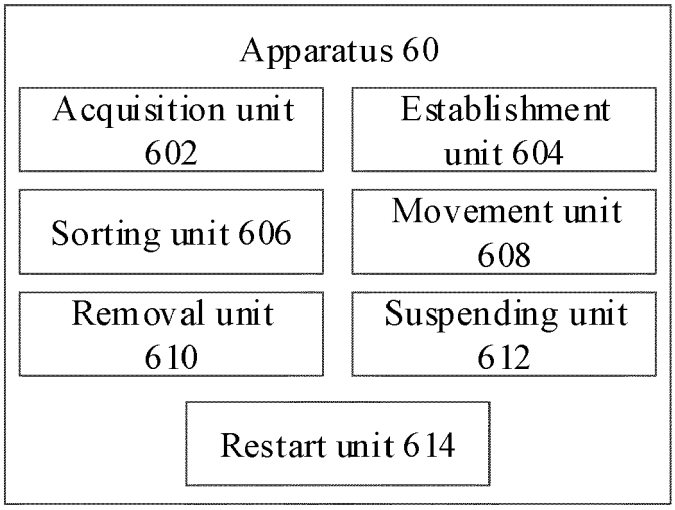
Apparatus 60
Acquisition unit 602
Establishment unit 604
Sorting unit 606
Movement unit 608
Removal unit 610
Suspending unit 612
Restart unit 614

FIG. 6

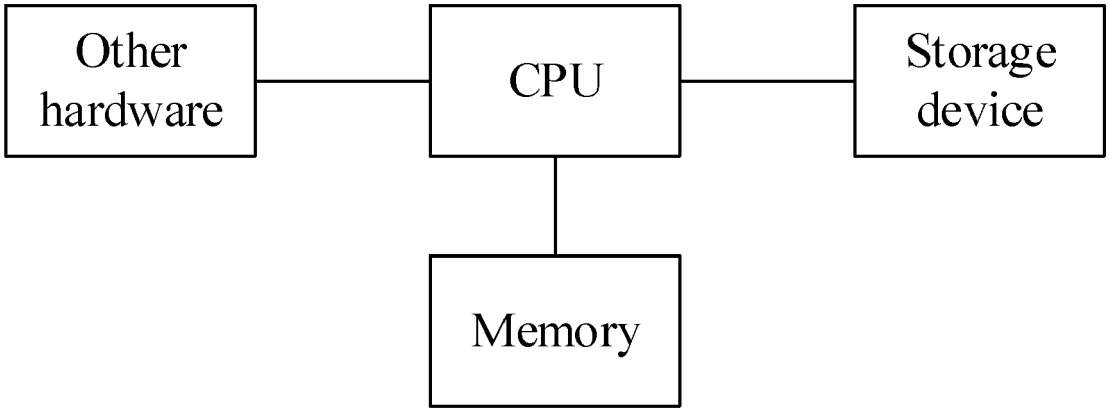
Other hardware
CPU
Storage device
Memory

FIG. 7

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 21 18 0318

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2020/177373 A1 (KOMANDUR VENKATADRI KAUSHIK [CA] ET AL) 4 June 2020 (2020-06-04) * abstract * * paragraphs [0067] - [0303] * * figures 1-14 * -----	1-12	INV. H04L9/32
A	US 2020/151269 A1 (CHRISTIDIS KONSTANTINOS [US] ET AL) 14 May 2020 (2020-05-14) * abstract * * paragraphs [0001] - [0088] * * figures 1-4B * -----	1-12	

TECHNICAL FIELDS SEARCHED (IPC)

H04L
G06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	17 November 2021	Mariggis, Athanasios

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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17-11-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2020177373 A1	04-06-2020	CA 3061603 A1	14-05-2020
		US 2020177373 A1	04-06-2020
US 2020151269 A1	14-05-2020	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82